SAFE WATER TECHNOLOGIES, INC.

INSTALLATION, OPERATION, MAINTENANCE MANUAL

UVME SERIES

ULTRAVIOLET WATER TREATMENT SYSTEM

1 LAMP MODELS

UVME-1S: 19 GPM, 2 INCH MNPT

UVME-1H: 35 GPM, 2 INCH MNPT

2 LAMP MODELS

UVME-2H: 60 GPM, 2 INCH MNPT

3 LAMP MODELS

UVME-3S: 80 GPM, 2 INCH MNPT

UVME-3H: 135 GPM, 3 INCH MNPT

4 LAMP MODELS

UVME-4S: 100 GPM, 2 INCH MNPT

UVME-4H: 170 GPM, 3 INCH MNPT

MAY 2017

TABLE OF CONTENTS

SAFETY INSTRUCTIONS

In order to protect end users and operators from injury, safety precautions must be followed. This Installation, Operation and Maintenance (IOM) Manual outlines important safety issues.

1) INFORMATION

Please read this manual prior to installing, starting up, and operating the equipment. The equipment uses the latest in UV technology, and has been designed to make operation and maintenance easy.

The quality of the liquid entering the UV system needs to be monitored. Based on water quality, the UV system will need to be cleaned on a periodic basis. Maintenance of the UV system will require replacement parts. It is suggested that key spare and replacement parts be kept on hand. For best operation, always use manufacturer recommended replacement parts. Other replacement parts could result in damage to the system and void the warranty.

2) ABOUT ULTRAVIOLET (UV) DISINFECTION

The technology uses UV light to target and disable disease-causing microorganisms and pathogens.

Over 100 years ago, scientists discovered that if you exposed pathogens to UV light, their reproduction was limited. The UV light source they used resided in the UVC range of the light spectrum. Specifically, they discovered that light in the 254 nanometer (NM) range was the most effective wavelength for this process.

When many pathogens are exposed to UV light, their cells become damaged and this damage inhibits reproduction. The UV light, produced by a special UV lamp, damages the cells' DNA and RNA and once damaged, they are unable to replicate. This physical process renders them harmless. The amount of damage is a result of the intensity of the UVC output multiplied by the time the pathogens are exposed to the light. The applied dosage is commonly referred to as microwatts or millijoules and is often expressed as $\mu Ws/cm^2$ or mJ/cm^2. Most industrial applications require a UV dosage of 30,000 $\mu Ws/cm^2$ or 30 mJ/cm^2.

Why are plants and operators selecting UV technology?

a) UV is considered a green technology
b) No chemicals are added, so there is no need for chemical removal
c) No chemical storage
d) UV works instantly without requiring a residence time
e) Easy maintenance

3) MAJOR COMPONENTS

The UV disinfection system comes with a number of components. It is recommended to inspect the unit upon arrival.

a) Disinfection Chamber
The chamber is manufactured from high-grade 304 stainless steel. The chamber has MNPT inlet/outlet connections, an FNPT drain port, and monitoring port.

b) Electronic Control Center (ECC)
The ECC is attached to the top of the disinfection chamber.

The ECC requires clean power. Information on voltage and cycle will be on the wiring diagram inside the ECC cover. Equipment should be kept off lines where there are surges or brownouts. **Always disconnect power before servicing the system.**

The ECC contains the ballasts and other electrical controls. The ECC will display operation status such as individual lamp status indicators, elapsed runtime meter (ERTM), optional UV monitor, and optional high heat indicator.

c) Manual Quartz Sleeve Wiper System
The quartz sleeve wiper system is manually operated utilizing a push/pull system. A wiper extension rod slides through the wiper seal nut, through the lamp head plate, and down into the vessel. Quartz sleeves are inserted through the wiper rings.

d) Lamps and Quartz Sleeves
Use cotton gloves when handling lamps and quartz sleeves to prevent them from becoming dirty. If you break the lamps or quartz sleeves, take extra care to prevent self-injury.

If damage has occurred during shipment, please put to the side in the original packaging and contact the supplier. A claim will have to be made immediately to the shipping company.

4) PREPARATION FOR INSTALLING UV SYSTEM

a) Water Quality

For optimum performance of the UV system, water quality is extremely important. Proper pretreatment is essential for the UV system to operate as intended.

UV disinfection dosages are dependent upon the quality and clarity of the incoming water. Impurities in the water can interfere with the UV intensity and cause the dosage to fall to unsafe levels. Have the water tested to determine that it meets the standards in Table 1. If any of the elements exceed the maximum levels shown in Table 1, contact your water professional for recommendations for proper pretreatment.

The following Table 1 shows levels that are recommended for installation:

Table 1 — Recommended Water Standards for Installation

Element	Recommended Maximum Levels (1mg/L=1ppm)	Actual Value
Turbidity	<5 NTU	
Suspended Solids	<5 mg/l	
Color	None	
Iron	0.3 mg/l	
Manganese	0.05 mg/l	
pH	6.5 to 9.5	
Hardness	<120 ppm	

b) Important Safety Information

Read and follow all safety precautions to guard against injury. Basic safety precautions must be observed. Keep on hand for future reference.

UV lamps and their quartz sleeves can become razor sharp if broken. Take care when installing and removing quartz sleeves. Only hand-tighten compression fittings. Do not use wrenches or other tools.

CAUTIONS:

- UV light is extremely harmful to eyes and skin and will cause burns.
- Do not look directly or indirectly at the UV light. Do not expose your skin for any prolonged time.
- Use protective clothing and eyewear (make sure it is UV resistant) when servicing equipment.
- If accidentally exposed to UV light for an extended period, immediately seek medical attention.
- Symptoms for eye exposure include burning, itching, and redness. Symptoms for skin exposure are similar to sun burn.
- Use cotton gloves when handling lamps and quartz sleeves. Skin oils will adhere to the lamps and quartz sleeves and prevent UV light from properly emanating. If the sleeves become dirty, wipe them with a lint free cloth with denatured alcohol.

c) Optimizing System Performance

The UV lamps and their corresponding quartz sleeves need to be maintained. As a general rule, the lamps need to be changed after a year of usage (10,000 hours). Quartz sleeves should be changed about every three (3) years or sooner if degraded and/or damaged.

Quartz sleeves also need to be cleaned on a periodic basis based on real world operating conditions. The manufacturer recommends using denatured alcohol or a commercially available non-abrasive cleaning product. It is important that the cleaning product used leaves no residue.

Always remember to wear gloves when handling lamps and sleeves.

d) Environmental Issues Relating to UV Lamps

UV lamps need to be recycled like fluorescent lamps because they contain mercury. Please follow your local recycling laws. Visit www.lamprecycle.org for help finding a recycling center in your area. In the event that you are unable to find a disposal location, contact your manufacturer's representative.

e) Receiving UV Equipment and Spare Parts

Inspection of the UV equipment must be made immediately upon receipt for damage and verification of contents. It is important to compare the contents of your shipment to the actual packing list. Any deviations must be brought to the supplier's attention. Additionally, lamps and quartz sleeves need to be inspected for damage. If shipment or parts are damaged, immediately contact the supplier and hold broken contents and their containers for inspection by the shipping company. Failure to make a damage claim within two (2) business days of receipt of product can result in loss of claim.

f) Electrical Configuration and Maintenance

The UV disinfection system uses sophisticated electronics and specialty lamps. The UV system's electronics require clean power. The system has been designed to use a certain specified voltage. UV equipment must be protected from surges. If the location of the UV system is susceptible to brownouts, contact your manufacturer's representative.

5) INSTALLATION

Qualified professionals (contractors, plumbers, electricians) should install the mechanical and electrical components to code as per the engineering documents.

a) Wiring the Unit

Make sure power to the equipment matches the voltage requirements of the system. Make sure the system is properly grounded. Plug the power cord into the appropriate outlet.

b) Chamber

Ensure that there is adequate space on the lamp side of the vessel to insert and remove the quartz sleeves and UV lamps—40 inches or more is recommended. Without sufficient space, the lamps and quartz sleeves will be impossible to install.

c) Quartz Sleeves and Manual Wiper System

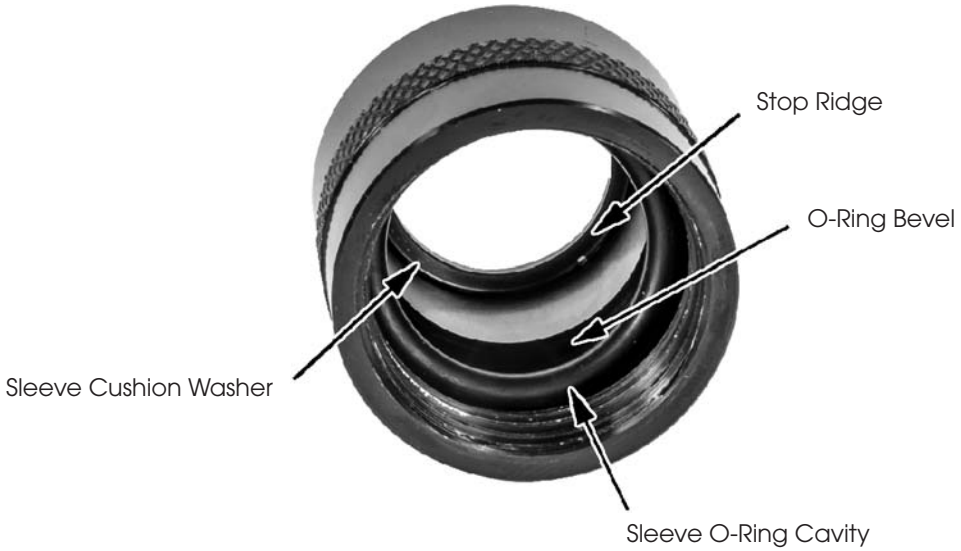
When working on this task, a single operator is appropriate.

Installation of quartz sleeves can be difficult if thought has not been given to the proper space allocation requirements listed in chamber installation above.

The quartz sleeve wiper system is manually operated utilizing a push/pull system. A wiper extension rod slides through the wiper seal nut, through the lamp head plate, and down into the vessel. The quartz sleeves are inserted through the wiper rings. It is necessary to wet the outside of the quartz sleeves, making them slippery before installing. Make sure the quartz sleeves are aligned properly with the wiper rings.

The quartz sleeves seal by using a compression nut and compressing an o-ring. This task requires no tools. Use cloth gloves to handle quartz sleeves and UV lamps to avoid putting fingerprints on the sleeves and lamps.

The compression nut includes several features designed to provide a watertight seal. It has a stop ridge to securely hold the quartz sleeve in place, an o-ring cavity to hold the sleeve o-ring, and an o-ring bevel to properly seat the o-ring between the nut and sleeve.

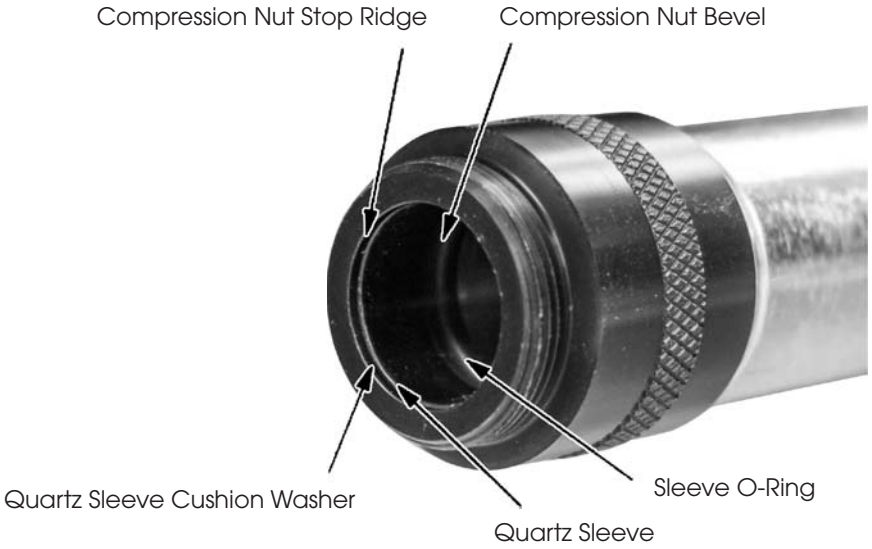


First, place the o-ring onto the end of the quartz sleeve as shown below.

Note: The o-ring should slide down the quartz sleeve about 1/4 inch. More than 1/4 inch can make installation more difficult.

Next, insert the compression nut over the o-ring and quartz sleeve until it snaps into place. A slight rocking back and forth of the compression nut over the o-ring will help this seat into place. The o-ring should be around the sleeve inside the compression nut. If not, remove the compression nut and repeat the process.

Note: Once seated in place, you should be able to turn the compression nut freely.



Hand tighten the compression nut until the quartz sleeve makes contact with the stop ridge. Once the compression nut is tightened, inspect the nut to make sure the sleeve has been pushed to the stop ridge as shown above. The compression fittings should be hand tightened only. Complete this procedure for each quartz sleeve.

Do not use a wrench to tighten the compression nuts. Doing so can crack the quartz sleeves and cause leakage.

DO NOT install the UV lamp at this time.

Once secure and once all other ports are closed, it is time to pressurize the system to look for any leaks at the compression seals. Before pressurizing, make sure to stand to the side of the system as the wiper rod may be forced out. Slowly fill the vessel with water. Prevent any onrush of water or water hammer as this may damage the sleeves. Also ensure that the UV lamps have not been placed in the vessel. In the event of a water hammer, the quartz sleeves may break, and if the lamps are already installed, they too could break.

Once pressurized, let stand for 10 minutes and inspect the seals. If any are found to be leaking, stop the water, release the pressure, drain the system, and then reassemble the leaking seals. Once reassembled, run the pressurization test and ensure that all seals are not leaking.

d) UV Lamps

Use cloth gloves when handling UV lamps to avoid placing fingerprints on the lamps.

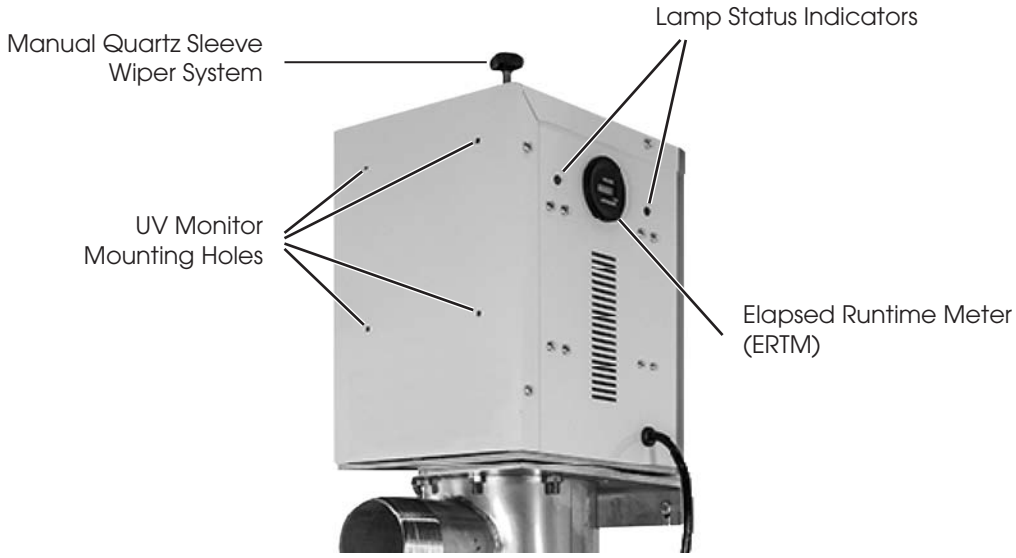
The electrical path for each lamp is identified and carried through the whole electrical system (e.g., the LED on the electronic control center for lamp #1 corresponds to lamp #1 in the UV chamber.). Each lamp harness is numbered and each lamp nipple is numbered on the lamp head plate. Match the corresponding numbered lamp lead to the corresponding numbered lamp nipple.

Insert the lamp cushioning spring into the quartz sleeve and slowly slide the lamp into the sleeve—blank end first, pin end last. Leave the lamp protruding out of the sleeve far enough to be able to push the lamp connector onto the lamp. Make sure the lamp connector is firmly pushed onto the lamp base leaving no space between the connector and base. Failure to push the lamp connector all the way onto the base may allow electrical arcing to occur between the pins, overheating the lamp, and possibly causing a fire. Feed the lamp into the sleeve and screw on the compression nut cap. Repeat for each lamp. The caps hold the lamp harness in place and prevent exposure to UV radiation.

6) OPERATION AND MONITORING

Electronic Control Center (ECC)

The ECC is attached to the top of the disinfection chamber. It contains the ballasts and other electrical controls. The ECC displays operation status via lamp status indicators, the elapsed runtime meter (ERTM), an optional UV monitor, and an optional high heat indicator.



a) Lamp Status

Light Emitting Diodes (LEDs) located on the display plate of the ECC display the status of each individual UV lamp. The LEDs glow green when the corresponding lamps are on. An extinguished LED indicates a possible lamp problem.

If the LED goes off, then it may mean that the corresponding lamp is no longer functioning. Additionally, it may indicate a problem with the LED, the lamp's corresponding ballast, or a problem located within the lamp holder.

b) Runtime Monitoring

A digital non-resettable time meter has been integrated into the display plate of the ECC. This elapsed runtime meter (ERTM) tracks the operational hours of the UV system as a whole. It does not track individual lamp run hours, nor does it indicate when to service. The runtime meter is a tool to help track running hours to help operators know when it is time to change lamps.

Operators should keep tracking logs in order to know when it is time to change lamps. Lamps need to be changed every 10,000 hours (one year). UV lamps lose intensity over time and the system is designed to provide proper dosage up to 10,000 hours of lamp life. Running the lamps more than 10,000 hours could result in improper UV dosage.

c) Manual Quartz Sleeve Wiper System

Water quality will determine the frequency of operating the manual wiper system. It is recommended to use the wiper system weekly—although, this task may be performed more often or less, depending on the water conditions. Always operate the wiper system with a straight and even stroke.

d) UV Monitor (Optional)

Operation

The UV monitor option consists of a UV sensor probe, a UV monitor board, and a UV digital display. UV light output is measured from lamp #1 at the top of the disinfection chamber by the UV sensor probe. A signal is sent to the UV monitor board for processing, and displayed as a percentage value from 0–100% on the digital display.

When new lamps are installed, the board must be calibrated to 100% for the new lamps. As the lamps age and UV intensity falls, the UV display will reflect the lowered UV intensity. When the UV intensity falls below the SET point, the meter board relay will trip, sounding an audible alarm, illuminating the low UV lamp on the display, and switching the state on the contact outputs on the board.

Installation

1. Using the four mounting holes located on the front face of the ECC, attach the UV monitor to the ECC.

2. The view port on the UV disinfection chamber must be removed and the new sensor probe assembly installed.

   The UV System must be depressurized and drained of water before this step.

   Do not use a wrench to tighten the sensor probe. This can only be done by hand tightening. **Do not overtighten**, as this could break and damage the sensor probe assembly.

3. Connect the UV sensor probe's female BNC connector to the male BNC connector on the UV monitor.

4. Plug the UV monitor's power cord into a wall outlet with the appropriate required voltage.

5. An audible alarm will sound for approximately three (3) minutes when the UV monitor is turned on. This is due to a time delay designed to allow the ultraviolet lamp(s) to heat up and reach the safe output level.

   Proper eye protection should be worn when working with UV lamps.

   All installation and maintenance should be done in accordance with state and local electrical and building codes.

Calibration

The ultraviolet meter can only be calibrated when the power switch is in the ON position and the lamps are operational. Prior to any calibration, allow the lamps to warm up for at least three (3) minutes. Only lamps that have been operational for 100 hours should be calibrated.

To set the low UV intensity alarm:

1. Push and hold down the SET button. (See Figure 1.)

2. The low SET point of the meter should be set at 60–80%. If adjustment is needed, turn the SET potentiometer (see Figure 2) clockwise to raise the SET point, or turn counterclockwise to lower the SET point.

3. Release the SET button to return to the Run position.

4. To test for low UV intensity, turn the SCALE potentiometer (see Figure 2) below the SET point level.

5. Adjust SCALE display to 100% to return to the Run position.

Figure 1

Figure 2

7) MAINTENANCE

It is recommended that all installation and maintenance procedures should be done in accordance with state and local electrical and building codes.

NOTE: ALWAYS DISCONNECT POWER BEFORE SERVICING THE UV SYSTEM!

a) UV Lamp Maintenance

Most ultraviolet lamps are rated to provide 10,000 hours of continuous use. After 10,000 hours, the lamps may no longer provide the sufficient amount of 254nm or 185nm that is required for effective UV output. Therefore, the lamps need to be replaced on a yearly basis. Lamp status should also be checked on a periodic basis by inspecting the LEDs on the ECC.

It is best to always keep spare lamps available in case of emergency needs.

If it becomes necessary to clean the lamps due to dust or fingerprints, the lamps can be cleaned with denatured alcohol. Use cotton gloves and a clean cloth when cleaning the lamps. Wait for lamps to cool before cleaning.

b) Quartz Sleeve Maintenance

FRAGILE: Be careful when handling quartz sleeves! Always use cotton gloves when handling.

In order to ensure proper disinfection, the quartz sleeves need to be inspected, monitored, and maintained. The UV lamps produce heat and UVC output, which may cause certain water characteristics to adhere to and bond on the sleeves, preventing the UVC from reaching the targeted pathogens. This can cause the quartz sleeves to foul. To a great extent, the frequency of cleaning will depend upon the water quality. The more minerals present in the water, the more often the quartz sleeves will require cleaning.

Manual Cleaning

Significant film or debris deposits formed on the quartz sleeves will impair the ability of the ultraviolet rays to penetrate through the quartz and into the water.

A periodic visual inspection of the quartz sleeves will be necessary to determine the frequency of cleaning. Initial inspection should take place after thirty (30) days of operation. If the sleeves are dirty, shorten the cleaning intervals. If the sleeves are clean, lengthen the cleaning intervals.

To clean quartz sleeves, depressurize the unit by first turning off the inlet valve and then the outlet valve of the vessel. Turn off the power to the UV system. Drain the vessel. Disconnect the lamps, allow to cool, and slowly and carefully remove the lamps using clean cotton gloves. Back off the compression nuts and remove the o-rings. The quartz sleeves may be cleaned with denatured alcohol. If this is not adequate, a mild non-abrasive cleaner can be used. It is important to use cleaners that leave no residue. Remember, quartz sleeves are fragile, so always be careful when handling. Whenever the quartz sleeves are cleaned , the quartz o-rings should be replaced. Install the quartz sleeves with clean cotton gloves.

c) Manual Quartz Sleeve Wiper System Maintenance

Water quality will determine the frequency of operating the manual wiper system. It is recommended to use the wiper system weekly; however this task may be performed more or less often, depending on water conditions. Always operate the wiper system by plunging back and forth with straight and even strokes.

The wiper seal nut assembly (where the rod enters the chamber head) contains o-rings that may need to be changed. The wiper seal nut assembly prevents water from escaping through the wiper extension rod of the pressurized system. The wiper seal nut assembly consists of a total of three (3) Viton o-rings. If leaking occurs at this point, the wiper seal nut assembly may need to be replaced. To replace, unscrew the existing seal nut and install a new one.

d) ECC Maintenance

The Electronic Control Enclosure (ECC) should require little maintenance other than occasional cleaning. A damp cloth and mild detergent can be used to clean the outside of the enclosure.

Any water penetrating the ECC enclosure can lead to damage and possible electrical shock.

e) Chamber Maintenance

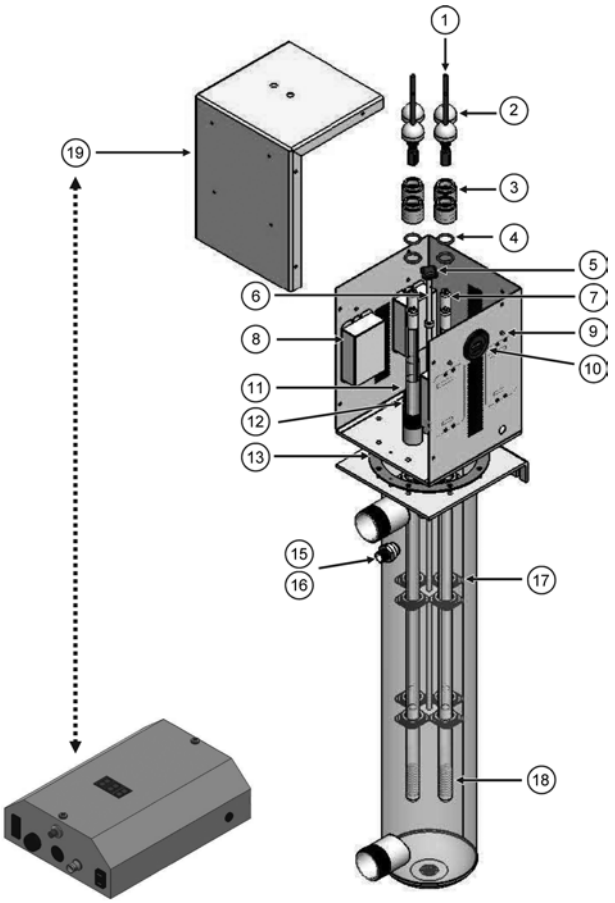
The disinfection chamber requires periodic maintenance. The chamber is made of 304 stainless steel and is designed to provide years of reliable service.

The exterior of the disinfection chamber can be cleaned with a damp cloth and mild detergent or a stainless steel cleaner. Be careful around the compression nuts as the compression caps are not watertight. The chamber interior will require cleaning on a periodic basis depending on the quality of the water passing through. Some water will introduce solids, minerals, and other debris in the vessel. It is recommended to frequently Inspect the vessel .

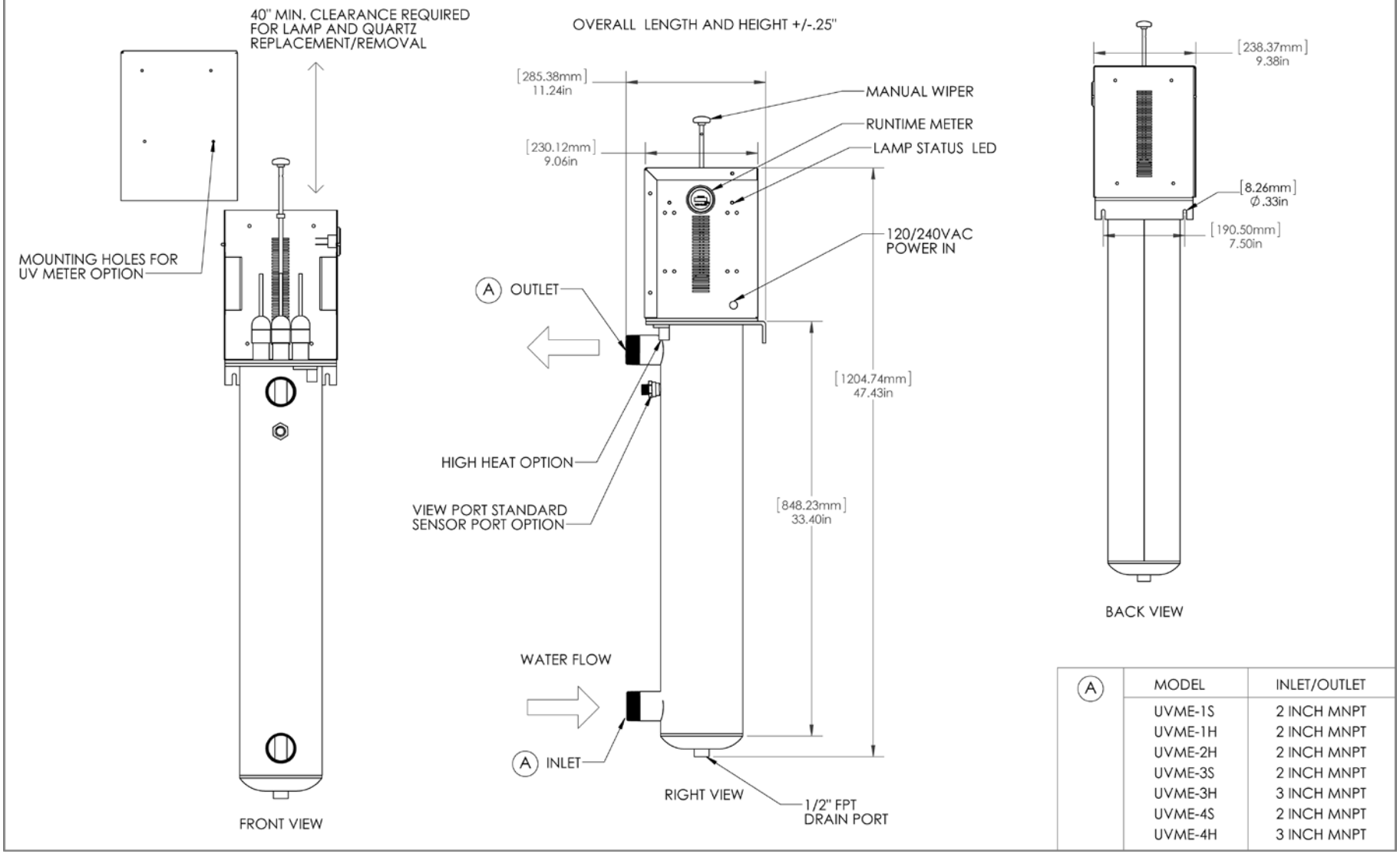
Prior to performing inspection, ensure that the water supply and the power to the ECC have been turned off. Once isolated, drain the system. Prior to draining, release in-line pressure by opening a valve. Failure to do these tasks can result in serious injury and property damage.

Once drained, the operator can remove a lamp and quartz sleeve to peek through a nipple in the lamp head to get a limited view of the vessel. The UV sensor probe (if so equipped), or the view port can also be removed to inspect the chamber.

UVME SERIES REPLACEMENT PARTS



Item No.	Description	Quantity Required						
		UVME-1S	UVME-1H	UVME-2H	UVME-3S	UVME-3H	UVME-4S	UVME-4H
1	Lamp Harness	1	1	2	3	3	4	4
2	Compression Cap	1	1	2	3	3	4	4
3	Compression Nut	1	1	2	3	3	4	4
4	Sleeve O-Ring, EPDM	1	1	2	3	3	4	4
5	Quartz Wiper Knob	1	1	1	1	1	1	1
6	Wiper Extension Rod	1	1	1	1	1	1	1
7	Standard Output Lamp—254nm	1	—	—	3	—	4	—
	High Output Lamp—254nm	—	1	2	—	3	—	4
8	Ballast—Standard Output Lamps	1	—	—	3	—	4	—
	Ballast—High Output Lamps	—	1	2	—	3	—	4
9	Lamp Status Indicator	1	1	2	3	3	4	4
10	Elapsed Runtime Meter	1	1	1	1	1	1	1
11	Quartz Sleeve, Domed	1	1	2	3	3	4	4
12	Wiper Seal Nut Assembly	1	1	1	1	1	1	1
13	Head Gasket	1	1	1	1	1	1	1
14	Thermistor (Optional)	1	1	1	1	1	1	1
15	UV View Port	1	1	1	1	1	1	1
16	UV Sensor (Oponal)	1	1	1	1	1	1	1
17	Wiper Ring	3	3	6	9	9	12	12
18	Quartz Spring	1	1	2	3	3	4	4
19	UV Monitor (Oponal)	1	1	1	1	1	1	1



A	MODEL	INLET/OUTLET
	UVME-1S	2 INCH MNPT
	UVME-1H	2 INCH MNPT
	UVME-2H	2 INCH MNPT
	UVME-3S	2 INCH MNPT
	UVME-3H	3 INCH MNPT
	UVME-4S	2 INCH MNPT
	UVME-4H	3 INCH MNPT

TROUBLESHOOTING

Problem	Recommended Action
UV lamp LED light is out	• Check lamp socket connection. • If lamp is on, replace LED assembly..
UV lamp is out	• Exchange lamp connectors from quesonable lamp to known good lamp. If lamp lights, replace bad lamp. • If the lamp does not light, exchange lamp connectors at enclosure from quesonable ballast to known good ballast. If lamp lights, replace ballast. • Check input voltage. Must be above 110V/60Hz or 220V/50Hz. Install voltage regulator or check for floating neutral at power source.
Short lamp life	• Damper excessive vibration which causes degradation of lamp filaments by checking for poorly connected pipes, erratic or improperly installed pumps, or move the UV equipment to isolate it from vibration. • Consult manufacturer for frequent start/stop requirements (recommend not more than six (6) in 24-hour period).
Leak at quartz end plate	• Replace defective or cracked quartz and/or o-ring. • Ensure compression nut is tightened and o-ring is sealed properly. • Ensure quartz sleeve is not cracked.
Low UV monitor reading (Less than 80% transmission)	• Check water quality. Ensure that color, turbidity, and iron content are within normal parameters. • Verify lamp output. • Ensure input voltage matches requirements. • Replace old or defective lamp(s). • Clean UV sensor lens. • Clean quartz sleeve(s). • Ensure UV sensor cable is connected..
Poor bacterial performance	• Replace old or defective lamp(s). • Clean quartz sleeve(s). • Check water quality. Ensure that color, turbidity, and iron content are within normal parameters. • Verify sampling technique. • Verify flow rate. • Ensure proper sample valves are used. • Check for bypass valve contamination.

If questions still remain after completing a troubleshooting procedure, please contact the manufacturer.

MAINTENANCE LOG

You must perform routine maintenance in order to achieve optimum performance levels from your UVME Series Ultraviolet Water Treatment System. As you perform routine maintenance or necessary service on your system, record the dates in the Maintenance Log below. The "Maintenance" section of the IOM Manual provides instructions for servicing and maintenance procedures.

Model Number:	**Serial Number:**

UV Lamp Replacement (every 365 days)	**Quartz Sleeve Cleaning (as needed)**	**Quartz Sleeve Replacement (every 3 years)**	**O-rings Replacement (with sleeve change)**